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Draft EWA Water Quality Assessment
March-June 1999 Gaming (Games 1, 2, 4 and 5)

Constituents of concern: TDS, chloride, bromide, organic carbon.

Scope of Assessment: Game 1, 2, 4 and 5, comparison with Accord and D-1485

Assumed Assets for Games 2-5: $10 M/year, no carryover.

Water Quality Actions: Typically, options were purchased in the fall. The options were called when the hydrology remained dry through the winter and early spring. Then the options were exercised in the summer and fall months to increase Delta outflow above the minimum required. Most actions included a purchase of 90 taf, raising outflow by 30 taf (500 cfs) for 3 months.

Conclusions (preliminary):

Game 1 and 2. With respect to seawater intrusion, Game 1 concerns involve reduction of outflow in the fall when outflow is in the 3,000-10,000 cfs range. Use of JPOD and larger Banks capacity in conjunction with fishery protection actions which shift exports into the fall (summer exports are often maximized anyway) can result in decreased surplus in fall months. EI ratio relaxations which occur in the fall, winter or June (probably the best month for TDS/Cl/Br concentration, on average) could also lower Delta outflow and increase salinity (see figures 1-3).

Game 2 was the first game to include water quality assets. Most, if not all, of the seawater intrusion impacts associated with the EWA (including increased export capacity) could be mitigated if these assets and their usage are realizable. The salinity improvement for Game 2 (figure 8), relative to Game 1 (figure 7), results from the application of the water quality assets. Notice that the <u>peak</u> salinity is reduced.

EWA actions that tended to reduce exports in the February and March effectively decreased export-weighted DOC. Increases to the DOC load at municipal intakes as a result of Delta island storage operations were also estimated (Table 2). These calculations are crude and are intended to display general operation features and trends. In summary, preliminary analysis indicates that export shifting and Delta island storage, for years that were gamed and for the assumed operational rules, appear to have the same order of magnitude of influence with respect to DOC loading; export shifting (for fish) being positive and Delta island storage being negative. Detailed assessment is deferred to CUWA/CALFED/Delta Wetlands. Quarterly instead of annual averages must also be considered.

Games 4 and 5. These games did not actively include water quality assets (as reflected in figures 9 and 10). Presumably, the inclusion of them would produce the same result as Game 2. Export-weighted DOC appears to decrease from about 4.4 mg/L to 4.25 mg/L in both games as a result from the EWA actions (Table 1). Games 4 and 5 did not include Delta island storage.

Comparison with D-1485 and Accord. Figure 6 shows that the Accord standards lower salinity in the spring of drier years compared to D-1485. Table 1 shows that DOC is also lowered with the Accord standards because of the pumping shift out the spring. Reference to figure 4 shows the annual DOC peak in the early spring. Application of pumping restrictions in the spring (e.g., VAMP, or the Accord-type pulse flow) will lower the export-weighted DOC load.

[**Disclaimer:** The D-1485 and Accord values used outflow results from DWRSIM while the gaming results depended on the J&S model. Outflow requirements vary between the two models for the same study for various reasons. This makes it difficult to compare D-1485 and Accord studies with the gaming studies. However, comparison between gaming studies and between the Accord and D-1485 results is consistent.]

General Remarks (preliminary):

- **Water Quality Gaming:** If the water quality assets are obtained and used in the manner reflected in the gaming, then water quality benefits (as measured by lowering of peak values of TDS/Br/Cl) can be achieved. Because of the nature of the water quality assets (that is, we were given paper water instead of wet water), there was a limitation on the ability of the water quality players to affect operations. Without real collateral operations cannot realistically be influenced.

Another lesson from the gaming was identification of the possible benefit that could be achieved by delaying exports during the annual DOC peak in the early spring. The peak is typically short-lived; limited pumping in this regime could lower the DOC load. If the water quality players had wet assets this could be achieved. The targeted fisheries could also benefit if they were near the export pumps during this time.

- **TDS/Cl/Br:** adjustments to outflow in the fall will affect salinity in the south Delta if the Delta has been in balance in the preceding months. Any operation which indirectly decreases outflow through reoperation (when outflow is 3,000-10,000 cfs) could have adverse impacts on salinity. A common example is when exports are increased in the fall during surplus months. The possibilities of salinity reduction in exports and diversions resulting from Delta island storage need more study. TDS/Cl/Br concentrations at CCWD's intakes could be reduced through increased exports in high-outflow months depending on the timing, operation of barriers and location of drainage events (more study needed).

- Independent of Delta island storage operation, the EWA gaming operations, as well as the application of the Bay-Delta Accord standards, have acted to lower export-weighted **DOC** from about 4.5 mg/L to about 4.3 mg/L. This is caused by the gradual

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shifting of exports from the spring period (when distinct DOC concentration spikes typically appear) to other times of the year.

- Bacon Island operations have the potential to increase DOC in exports due to the timing of the diversions to storage and the interaction between peat soils and shallow water storage. Bacon Island releases are assumed to be directly deposited in CCFB. Webb Tract operations may have more potential to increase DOC. In the Games 1 and 2, water was stored for a longer period on Webb Tract (see figure 4) and the differential between diverted DOC in the water and the DOC in the receiving water is larger. More agencies are affected with this operation because water is released back to the Delta (i.e., not directly exported). The portion of Delta storage releases that is received by municipal intakes will depend on the local hydrology in the Delta channels. This and other factors, including the effect of the land use change should be deferred to the **CUWA-CALFED-Delta Wetlands** study for detailed refinement.

Issues to resolve for water quality analysis:
- More extensive study is needed as operation details become more refined;
- Defer to CUWA/CALFED/Delta Wetlands study for in-Delta storage analysis. Existing/future land uses on Delta islands must be bracketed and factored into analysis; contributions of TOC loading from in-Delta storage at urban intakes; accumulation of TOC in stored water on peat Delta islands;
- Salinity-TOC tradeoffs (operations to reduce one may increase the other);
- Effectiveness of water quality operation rules (in progress) and common programs.

Outlier issues (items that need integration in order to make a full assessment):
- Barriers in the south Delta (head of Old River, hydraulic barriers)
- CALFED water quality common programs (e.g., agricultural drainage re-location/treatment, land use changes)
- Delta cross channel operations

Note: How were the water quality purchases for outflow linked to model output? I believe Russ's model includes this linkage but I could not find the relationship in Dave F's summary sheets.

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